

What if PCS is "Just Cellular"?

In one sense, the "worst case" for allowing current cellular service operators to acquire a portion of the frequency spectrum the Commission proposes to allocate to Personal Communications Services would obtain if PCS were identical to the mobile services that these operators currently provide and there are no efficiency gains from allowing current operators to provide PCS.<sup>40</sup> Where PCS is "just cellular," i.e., where PCS is service provided primarily to users in automobiles, it might be argued that the performance of the cellular market would improve if new entrants were to provide PCS in competition with incumbent firms.<sup>41</sup> However, even in this extreme case, the argument for restricting incumbents is far from straightforward.<sup>42</sup>

First, the argument is substantially weakened if a large amount of spectrum is assigned to PCS service and a significant number of new entrants are permitted to operate in this spectrum

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<sup>40</sup>As we make clear below, we do not believe it is reasonable for the Commission to proceed as if this "worst case" will, in fact, occur. We analyze this situation only to show that additional spectrum space could reasonably be assigned to incumbent cellular operators, or that these operators could be permitted to acquire additional spectrum, even in this situation. It follows, that there is even stronger support for this position if, as is almost certainly the case, PCS is not "just cellular" and if there are economies of scope between cellular and PCS.

<sup>41</sup>We recognize that cellular service already extends somewhat beyond this definition and may change even more in the future.

<sup>42</sup>We do not mean to downplay the importance of economies of scope or product heterogeneity, and we return to these issues below. However, we show here that there is a case for making additional spectrum assignments to PCS operators even where these conditions are absent and where we focus, as do the Department of Justice Merger Guidelines, on market concentration.

space along with the cellular incumbents. The exclusion of cellular incumbents cannot be justified easily if allocating additional spectrum space for the provision of PCS makes the cellular market less concentrated. It is the competitiveness of the market after, not before, the new allocation that measures market performance.

Second, the strength of the argument depends both on the proportion of the newly-allocated PCS spectrum that is acquired by the incumbent cellular operators and the distribution of capacity among other PCS providers. There is little competitive justification for preventing incumbent cellular operators from acquiring access to a small portion of the PCS spectrum.

One cannot judge the impact of an acquisition of a portion of the PCS spectrum by cellular operators on concentration in the cellular market without knowing the number and size of the rival suppliers remaining after such an acquisition. An acquisition that leaves more rivals is likely to have a smaller effect than one of the same size that leaves fewer rivals. In short, the effect on concentration of an acquisition by cellular operators depends not only on how much spectrum they acquire but on how many other players are in the market after the acquisition takes place.

Finally, basing any assessment of market competitiveness on the shares of capacity held by various firms can be highly misleading. For a number of reasons, we would expect the PCS market to be more competitive than such calculations would suggest. One important reason is that all new PCS providers would have to

compete vigorously to capture a share of the cellular market. As a result, we would expect any measure of concentration based on the capacities of firms to understate the degree of competition in the PCS cum cellular market.

Consider a situation in which the FCC makes available five new spectrum assignments for PCS, as proposed by CTIA. Assume, moreover, that each of these five assignments has the same capacity as each of the two existing cellular assignments. Assume, further, that each of the new assignments will be used only for the provision of cellular service, i.e., automobile radio.<sup>43</sup> Assume, next, that cellular operators face no competition from other sources<sup>44</sup>, e.g., Specialized Mobile Radio, ESMR, paging, etc.<sup>45</sup> Finally, assume that initially none of the five new assignments is made to an incumbent cellular operator.

Suppose, now, that one of the seven operators were to conclude that it can put a portion of the spectrum to a more valuable use than can one of its rivals that occupies that spectrum.<sup>46</sup> Suppose that it proposes to acquire, say, one-third of the spectrum space allocated to the rival, so that it now has 19 percent of the industry capacity while the seller's share is

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<sup>43</sup>Again, we recognize that this definition is too narrow.

<sup>44</sup>Clearly, this is another "worst case" assumption.

<sup>45</sup>ESMR can be used to offer dispatch services, mobile telephone service, vehicle location, facsimile and data transmission, and voice mail.

<sup>46</sup>Recall that, under the assumptions made here, there is no reason to distinguish between an incumbent cellular operator and a new licensee in judging the effect of an acquisition.

reduced to 9.5 percent.<sup>47</sup> Here, the Herfindahl-Hirschman Index (HHI) of concentration increases only by 43, to 1471, an increase that would not attract the attention of the antitrust authorities.<sup>48</sup>

Moreover, there are other ways in which an operator can increase its capacity from one-seventh to 19 percent of the market that have an even smaller effect on the HHI. Suppose that in order to accomplish this increase the operator obtains an equal amount of spectrum space from each of the other six operators, leaving each with 13.5 percent of the capacity of the industry. In this case, the acquisitions, although they give the acquiring firm 19 percent of the spectrum allocated to cellular-PCS, increase the HHI to only 1455, a rise of only 26. Despite the fact that the acquirer's share has increased by the same amount in the two cases, the impact on measured concentration is different. It is greater in the first case, where the single seller's share has declined by a large amount, than in the second, where each of the sellers has experienced only a modest reduction in its share. Indeed, since the increase in the second case is even smaller than that in the first, it, too, would not be subject to scrutiny by the antitrust authorities.

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<sup>47</sup>As we demonstrate below, efficient spectrum use is likely to require that licensees be able to combine or subdivide the initial allocations made by the Commission. Thus, it should not be regarded as unusual for transfers to involve less than an entire assignment.

<sup>48</sup>According to the Merger Guidelines, an acquisition that changes the HHI by less than 100 and results in an HHI less than 1800 will ordinarily require no further analysis.

Finally, we would note that the Commission has itself indicated that it may prefer to limit the amount of the PCS allocation that an LEC may acquire rather than entirely exclude the LEC from the provision of PCS service. The Commission has tentatively concluded "that 10 MHz may be sufficient for the initial deployment of a PCS system integrated with a wireline local operating company."<sup>49</sup> Even in the "worst case" considered here, limiting the amount of PCS spectrum that incumbent cellular operators can acquire is preferable to barring these operators completely from offering PCS.<sup>50</sup>

Even if one were to employ the Department of Justice horizontal merger guidelines rigidly and were to assume very conservatively that PCS is "just cellular," the case against permitting acquisitions of PCS licenses by incumbent cellular operators, either through initial assignments by the FCC or through purchases from initial licensees, is far from straightforward. The case is substantially weakened if a significant number of new assignments are made, as the Commission proposes to do, because that reduces the overall level of concentration as well as the

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<sup>49</sup>Notice, para. 77.

<sup>50</sup>The Commission notes that it could impose a restriction on the amount of spectrum that could be acquired by: (a) setting aside a smaller block in the initial assignments; (b) dividing blocks and allowing some firms to acquire only a portion of a block; or (c) limiting the amount of spectrum that could be acquired by some firms in the aftermarket. (Notice, para. 78)

impact on concentration of an acquisition.<sup>51</sup> The case is further weakened, if not eliminated, if incumbents obtain only a portion of any new assignment, because that leaves another firm with the remainder. Finally, because it can make a great deal of difference whether a given amount of spectrum is acquired from a single rival or from a number of them, the effect on concentration of a spectrum assignment to an incumbent cellular operator cannot be judged in isolation. Even if PCS is "just cellular," as it almost certainly is not, and even if there are no economies of scope between cellular service and PCS, a complete prohibition of cellular operators from the PCS band is not necessary to deal with the Commission's concerns about the adverse effect of market concentration.

#### The Benefits of Flexible Spectrum Use

Although it may seem unconventional to suggest that acquisitions of the spectrum that has been assigned to PCS might be for less than an entire assignment, in fact acquisitions of this type have long been advocated as a way of increasing the efficiency with which spectrum is used. For example, in their proposal for a market-based allocation system for the radio frequency spectrum, DeVany et al argued that the holder of a spectrum assignment should not be "restricted in the use to which his [allocation] may be

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<sup>51</sup>As the Commission observes, "If we grant five PCS licenses in each market, the competitive impact [of allocating one to an incumbent cellular operator] would be less than if only three licenses were granted per market." (Notice, para. 65)

put....Any [allocation] package, combination of packages, or subpackages may be legally used for TV broadcasting, industrial voice channel, diathermy, or any other use....No restriction [should be] placed on the transferability of [an allocation] in whole or part."<sup>32</sup> Indeed, DeVany et al note that "rights are more valuable and flexible when they can legally be subdivided and partially transferred....It is recognized that the cognizant federal agency will not be able to package [spectrum] rights optimally....The market system, given adequate freedom, will tend to recombine rights into more valuable patterns in response to changes in technology, population, and demand."<sup>33</sup> More recently, Webbink has argued that Commission licensees should be permitted "to buy, sell, sublease, share, divide and combine their spectrum use rights....If spectrum users were given those rights they would have stronger incentives to use spectrum efficiently, i.e., to use it in ways that lead to its highest valued use."<sup>34</sup>

Not only has permitting licensees to subdivide their assignments been advocated as a way to improve spectrum efficiency, the Commission has occasionally permitted such behavior. Webbink

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<sup>32</sup>A.S. De Vany, R.D. Eckert, S. Enke, D.J. O'Hara, and R.C. Scott, Electromagnetic Spectrum Management, TEMPO, General Electric Company, Santa Barbara, CA, August 1968, p. 37; emphasis added.

<sup>33</sup>Ibid., p. 38; emphasis added. Later they are even more explicit: "...rights should be transferable in part as well as in whole because both different uses and new technologies very often require new combinations of rights" (p. 54).

<sup>34</sup>D.W. Webbink, "Frequency Spectrum Deregulation, Property Rights and Markets: Where Are We Now?", presented at The Sixteenth Annual Telecommunications Policy Research Conference, November 1, 1988, p. 7; emphasis added.

has described a number of these instances.<sup>55</sup> He observes, for example, that "...when the FCC reallocated eight instructional fixed service (ITFS) channels to multipoint distribution service (MDS) use, the FCC decided to allow ITFS system owners to lease excess ITFS capacity for the transmission of entertainment programs and for other purposes unrelated to their educational activities."<sup>56</sup> And he notes that "...the FCC also decided to allow broadcast auxiliary facilities to be used for both broadcast and nonbroadcast purposes. The FCC also ruled that broadcast auxiliary facilities could be shared with other users and stations could earn a profit from that sharing."<sup>57</sup>

More recently, the Commission has adopted rules that allow cellular service providers to offer new services in the spectrum initially allocated for the provision of cellular telephone service. And, significantly, in the present proceeding, the Commission has evinced a desire to "adopt a PCS regulatory structure that allows similar flexibility in implementing new services and technologies."<sup>58</sup> As one specific example, the Commission has requested comments on "permitting aggregation for

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<sup>55</sup>Webbink's paper provides detailed chronologies of a wide variety of Commission actions that have promoted efficient spectrum use.

<sup>56</sup>Webbink, op. cit., p. 11.

<sup>57</sup>Ibid., p. 12.

<sup>58</sup>Notice, para. 24. Another example of the Commission's desire to promote efficient spectrum use in this proceeding is its proposal to give licensees "the flexibility to channelize the frequency blocks to accommodate the technologies and services that they wish to provide." (Notice, para. 38)



those providers [of narrowband PCS] that may need more than 50 kHz for their systems...."<sup>59</sup> Allowing licensees the freedom to combine or subdivide spectrum assignments as needed to provide new services is an excellent way in which to allow such flexibility.<sup>60</sup>

#### Spectrum Heterogeneity and PCS as a Different Service

PCS need not be "just cellular." If there are differences in the technical characteristics of the 850 MHz and 2 GHz bands that affect the services that are provided in these respective bands, it may be the case that some PCS are not good substitutes for traditional automobile cellular service. In such situations, the case for excluding incumbent cellular operators from the spectrum assigned to PCS is substantially weakened.

One possible form that PCS might take is handheld or portable cellular, or what occasionally is called CT service.<sup>61</sup> This is a quite plausible form for PCS because of certain differences in the

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<sup>59</sup>Notice, para. 51.

<sup>60</sup>Another is, of course, to give licensees substantial freedom to determine which services they provide with a given spectrum assignment. In this regard, the Commission's proposal to permit cellular operators specifically to "provide PCS-type services, such as wireless PBX, data transmission and telepoint services" in the frequencies currently assigned to them (Notice, para. 70) is especially welcome.

<sup>61</sup>Recall that when, in the previous example, we assumed that PCS was "just cellular," we were careful to limit that characterization to voice service to users in automobiles. Thus, in our lexicon, handheld or portable service is not "just cellular" if consumers do not regard it as a substitute for automobile service even if it employs a cellular technology. That is, it is important to distinguish between mobile and portable services.

technical characteristics of the 850 MHz and 2 GHz bands.<sup>62</sup> There appears to be general agreement that the 850 MHz band is better suited for services that cover broad areas and that there will be difficulty in effecting "handoffs" between cells for rapidly moving vehicles at the higher frequencies. This means that cellular operators using the 850 MHz band will have a comparative advantage over PCS operators in the 2 GHz band in providing service to users in automobiles, so that 2 GHz may be used primarily or entirely for offering handheld, or portable, cellular radio service.<sup>63</sup>

Suppose that there is no substitutability by users between automobile and handheld cellular radio service, so that a change in the price of one does not affect the quantity demanded of the other, at least for price changes from those that would prevail under competition.<sup>64</sup> Suppose, further, that cellular operators

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<sup>62</sup>We want to emphasize that, like the Commission, we are uncertain as to the precise form or forms that PCS may take. Nonetheless, in undertaking our analysis of competition in the PCS market or markets, we found it necessary to specify with some precision a number of alternative scenarios of developments in PCS. Although we are not prepared at this point to argue that any of these scenarios will actually occur, we are convinced that the more differentiated PCS is from "just cellular," the weaker is the case for excluding current cellular operators from providing PCS service.

<sup>63</sup>Although we focus in this section on handheld cellular radio, the analysis is intended to apply to any service that is not a perfect substitute for automobile cellular radio and where there are differences between the spectrum assigned to cellular and PCS services in their utility in providing the respective services. Because technology and the services that may be provided are changing rapidly, any attempt to categorize existing services definitively is likely to be quickly superseded.

<sup>64</sup>We appreciate that this assumption is a strong one and we make it at this point primarily for analytical convenience.

continue to offer automobile cellular service in the portion of the spectrum they currently occupy because either it is more profitable to do so or they are required to do so under the terms of their original spectrum allocation.<sup>65</sup> Finally, assume that automobile cellular cannot be offered at 2 GHz, for the technical reasons described above. The impact of the last two conditions is, of course, that there is no supply substitutability between automobile and handheld cellular services.

In the circumstances described here, automobile and handheld radio services are in different (antitrust) markets although they both use cellular technologies. In both cases, cellular technology provides the benefits of spectrum reuse but, under our assumptions, automobile service is only provided in the 850 MHz band. Thus, the prices of the two services are, over a wide range, independent, with the price of automobile cellular service exceeding the price of handheld cellular service.<sup>66</sup>

In this case, an increase in the price of service in the 2 GHz band is unlikely to cause many handheld users to switch to the higher-priced service in the 850 MHz band, which is intended primarily for automobile users. Moreover, cellular operators in

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<sup>65</sup>In this connection, the Commission notes that although "cellular...radio services will be able to provide some of the new communications requirements within their currently allocated spectrum, they cannot meet the full range of demand for PCS within a competitive framework." (Notice, para. 25)

<sup>66</sup>This occurs because automobile users need access to the spectrum at the lower frequencies more than do handheld users and are able to outbid them for such access. The difference in price is a rent that is received by those who control access to the higher-quality spectrum.

the 850 MHz band are unlikely to reduce significantly their service to automobile users by shifting some spectrum to the provision of the lower-priced, and presumably lower-quality, handheld service. Similarly, an increase in the price of service in the 850 MHz band is unlikely to cause many automobile users to switch to the lower quality service in the 2 GHz band, nor, by assumption, can service providers in the 2 GHz band switch to providing the higher-quality service demanded by automobile users.<sup>67</sup>

Under these circumstances, there would be no adverse effect on competition in either the PCS, i.e., handheld cellular, or "cellular," i.e., automobile cellular, markets if incumbent cellular operators were to acquire access to a portion of the PCS band. Given our assumptions, the prices of both PCS and "cellular" services would be unaffected by whether both services were provided by the same or different suppliers if there are no economies of scope, i.e., if the combined cost of providing the two services separately is the same as the cost of providing the two services together. A cellular operator that is not linked to a PCS operator would charge the same prices for cellular and PCS services as would two separately-owned services.

If cellular and PCS services are in different markets, a

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<sup>67</sup>Note that there is no inconsistency between assuming that automobile and handheld users compete for access to spectrum and concluding that the prices of the various services provided using the spectrum are independent in equilibrium. If a wine shop can outbid a book store by a wide margin for the right to occupy a given location, a small increase in the price of books will still leave the wine shop as the winning bidder and the price of wine will remain unchanged. The only impact will be on the rent received by the landowner.

cellular operator would only wish to offer PCS service if it were at least as efficient as other firms offering PCS. Greater efficiency might occur because the cellular operator has access to superior technologies, or has superior skills, or because there are cost savings when both cellular and PCS services are offered by the same firm.

Note that qualitatively similar results would be obtained even if automobile and handheld cellular services were highly imperfect substitutes. If only a small number of automobile customers were willing to shift to handheld service in response to a rise in the price of "cellular" service, even a firm that owned both PCS and cellular service providers would set the price of one with little regard for the price that prevailed for the other.

In general, if PCS is not "just cellular," but instead is a service that is only a partial substitute for cellular, concentration measures based only on capacity, without regard to the way in which that capacity is used, will exaggerate the impact on market competitiveness of granting a PCS license to a cellular operator.<sup>64</sup>

Moreover, the preceding analysis is not essentially changed if cellular operators choose to offer the handheld service in a portion of their current spectrum allocation. Given the technical differences between the 850 MHz and 2 GHz bands that have been discussed above, PCS operators cannot compete effectively in the

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<sup>64</sup>The same would be true, of course, in assessing the effect of the acquisition of part of a PCS license by a cellular operator.

automobile cellular market. However, if PCS operators were to raise the price of the handheld service, cellular operators would have an incentive to expand their provision of that service. If automobile and handheld services are not close substitutes for users, the price of the two services will not be increased if cellular operators are permitted to acquire a portion of the PCS spectrum.<sup>69</sup>

It should also be noted that if the owner of a cellular-PCS combination were to attempt to raise the price of PCS services, most of its customers who dropped the service would switch to rival PCS vendors rather than to the firm's own cellular service if cellular and PCS are imperfect substitutes. Thus, these rival suppliers would have substantial incentives to defect from any tacit agreement to raise the price of PCS service. Similarly, to the extent that cellular and PCS services are imperfect substitutes, if the owner of the combination attempted to raise the price of cellular service, it would likely lose a large proportion of those customers who switched to PCS to rival PCS suppliers.

A final point to note here is that significant advantages may accrue to mobile telephone customers if they are able to acquire both automobile and handheld services from a single supplier. If incumbent cellular operators are permitted to offer both automobile and handheld services, they can provide the service that these

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<sup>69</sup>In reaching this conclusion, we have assumed, plausibly, that cellular operators will find it profitable to dedicate only a relatively small portion of their current spectrum allocation to the provision of handheld service.

customers desire.

### Economies of Scale and Partial Acquisitions

A third type of situation that should be analyzed occurs if PCS is, at best, an imperfect substitute for cellular service and incumbent cellular operators can provide PCS at minimum efficient scale only if they can acquire additional spectrum. One possible example of such a situation occurs when PCS is high-speed data service to mobile users.<sup>70</sup> If this is the case, with current technology, service will be restricted to those firms that have access to large bandwidths.

Incumbent cellular operators may be able to provide data services while still serving their automobile voice customers, either by making use of unused portions of the space currently allocated to them or by making more efficient use of the spectrum currently used to offer voice service. However, unless they can obtain access to a substantial amount of bandwidth in this fashion, they will be limited to the provision of data services at relatively low speeds.<sup>71</sup> If high-speed data service to mobile users is one form of PCS, and if this service is not a close substitute for lower-speed data services, permitting existing cellular operators to acquire sufficient bandwidth so that they can

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<sup>70</sup>One should observe that PCS need not be just one thing. It is possible, for example, that they will encompass both high-speed data and handheld cellular services.

<sup>71</sup>The Commission's proposal recognizes that there may be differences among PCS in their bandwidth requirements. (Notice, para. 44)

provide high-speed data services will not adversely affect the competitiveness of the high-speed data market, and conceivably could improve it.

Consider a cellular operator that can, at some cost, reduce the amount of spectrum that it uses to provide automobile telephone service. Assume, however, that the amount of spectrum that is thereby released is too small to permit the operator to provide high-speed data service. Assume, further, that the increase in concentration in spectrum holdings that results from acquiring the additional spectrum that is needed is small. In these circumstances, the cellular operator should be permitted to acquire the additional spectrum even if it would be deemed anticompetitive for the operator to acquire the total amount of spectrum needed to provide the high-speed data service.<sup>72</sup>

#### Economies of Scope in the Provision of PCS

Economies of scope exist when it is less costly for a given combination of services to be produced by a single firm than for the same combination to be produced by two or more different firms. For some types of PCS, economies of scope are likely to exist for the provision of cellular and PCS. The situations in which such

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<sup>72</sup>Of course, if one could be certain that the cellular and high-speed data services were in different markets, one could permit the larger acquisition. However, even if one were not certain about the degree of substitutability between the services, and one concluded that additional spectrum sufficient to provide the high-speed data service should not be provided, one might still be willing to make a smaller allocation which, when combined with its existing allocation, permits the cellular operator to provide the data service.



economies are most likely are those where PCS involves the provision of additional services to the same users who are currently receiving cellular service.

Suppose that one form of PCS is the type of high-speed data service that we described above.<sup>73</sup> If this is the case, it will be possible for an existing cellular operator to provide this service without having to replicate substantial portions of its infrastructure.<sup>74</sup> Most importantly, the base stations that the operator has established, which can exceed 100 in number and which cost on the order of \$500,000 to develop, can be used to provide both sets of services.

The cellular operator will have to incur additional costs to provide the high-speed data service. For example, the costs of additional T1 links between the base stations and the Mobile Switching Center (MSC) and between the MSC and the Public Switched Telephone Network, as well as the costs of additional switching equipment at the MSC, would also have to be incurred by any PCS entrant. However, only the cellular operator will be able to avoid the cost of establishing the system of base stations. And, given the number of base stations in a typical system and their costs,

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<sup>73</sup>As we have already noted, handoffs are likely to be more difficult at the higher frequencies. As a result, it may be necessary for the customer to stop his vehicle during the period when the data transmission is being received.

<sup>74</sup>Again, we use the example of high-speed data service only as an illustration. The analysis in this section holds for any service that can be provided by an incumbent cellular operator to its existing customers without incurring significant costs that would have to be incurred by a PCS supplier offering only the new service.

the cost saving is likely to be substantial. For example, for a system with 100 base stations, the cost saving would be on the order of \$50 million.

#### The Role of Other Competitors

The discussion above proceeded on the unlikely assumption that competition occurred only among cellular and PCS firms, that is, firms that were licensed by the FCC in either the 850 MHz or 2 GHz bands. However, other firms are likely to be able to provide services that compete with those offered either by cellular or PCS firms. Even if these rival firms offer imperfect substitutes for PCS and cellular services, their presence can constrain the ability of PCS and cellular providers to raise prices.

Even if PCS were to turn out to be "just cellular," it would be important to take account of important alternatives to traditional cellular and PCS in judging the effects of excluding cellular operators from the PCS spectrum. Any analysis that fails to take these alternatives into account will overstate the threat to competition posed by permitting cellular operators to offer PCS service because it will overstate the market share held by a cellular ~~and~~ PCS operator.<sup>75</sup>

One important competitive alternative to traditional cellular is Enhanced Special Mobile Radio (ESMR) service, which the Commission recently authorized Fleet Call to provide. By (i)

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<sup>75</sup>It should be noted that these alternatives could also affect market competition even if PCS were not "just cellular."

consolidating radio frequencies that had previously been used by separate carriers to provide mobile telephone services, (ii) introducing digital technology, (iii) employing Time Division Multiple Access (TDMA) multiplexing, and (iv) using multiple base stations, Fleet Call will add substantially to the capacity of the industry to provide radio telephone service. One estimate is that the adoption of ESMR will increase the capacity of the SMR bandwidth by a factor of fifteen, and that ESMR will have the capacity to serve several million subscribers in the nation's largest markets, including New York, Chicago, Los Angeles, San Francisco, and Dallas.

In addition, ESMR will be able to offer additional services, including facsimile, data transmission, and vehicle location, that cannot be provided over SMR. Finally, service quality will be improved substantially in comparison to SMR. The combination of additional capacity, expanded service offerings, and quality improvement provided through the use of ESMR is likely to present a significant competitive check on the ability of cellular and/or PCS operators to raise prices.

### Conclusion

A blanket prohibition against the acquisition of PCS licenses by incumbent cellular operators cannot be easily justified. Even in the "worst case," where PCS is a perfect substitute for traditional cellular service, a portion of the spectrum that the Commission proposes to allocate to PCS can be acquired by

incumbents without significant threat of competitive harm. In the more likely cases where PCS is a weaker substitute for cellular, so that concerns about competitive harm are reduced, and/or where there are economies of scope between cellular and PCS, so that cost savings result when incumbents are permitted to offer PCS, an even larger acquisition of PCS spectrum by incumbent operators can be justified.

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1963-1965	Economist, Institute for Defense Analyses
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1972-1978	The Rand Corporation
1972-1977	Office of Telecommunications Policy, Executive Office of the President
1975	Texoma Regional Planning Commission
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Member, Advisory Board, Information Infrastructure Project, Science, Technology, and Public Policy Program, John F. Kennedy School of Government, Harvard University, 1991-present.

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Member, Office of Technology Assessment Advisory Panel on Communications Systems for an Information Age, 1986-1988.

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Member, Office of Technology Assessment Advisory Panel on Intellectual Property Rights in an Age of Electronics and Information, 1984-1985.

Expert, World Intellectual Property Organization/UNESCO Meeting on Unauthorized Private Copying of Recordings, Broadcasts, and Printed Matter, 1984.

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Member, Editorial Board, *Southern Economic Journal*, 1979-1981.

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Member, Technical Advisory Committee on Business Development, Model City Program, City of Houston, 1969-1971.

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